What is claimed is:

1. A process for making carbon black in a furnace-type reactor having a region into which feedstock oil is injected comprising:

supplying a hydrocarbon fuel to the reactor;

supplying air to the reactor to combust the hydrocarbon fuel and produce combustion gases;

injecting feedstock oil into the combustion gases to produce carbon black and a flue gas comprising hydrogen and oxides of carbon;

replacing the hydrocarbon fuel with a portion of the flue gas;

adding additional oxygen to the air supplied to the reactor to maintain the combustion gas temperature , oxygen concentration in the combustion gases, and total heat input rate in the region of the reactor into which feedstock oil is injected at about the same values which obtained when the hydrocarbon fuel was supplied to the reactor.

2. A process as recited in claim 1 further comprising removing a portion of the water vapor in the flue gas.

3. The process of claim 1 wherein the oxygen concentration in the combustion gases in the region of the reactor into which feedstock oil is injected is calculated from the temperature of the fuel supplied to the reactor, the rate at which fuel is supplied to the reactor, the temperature of the air supplied to the reactor, the rate at which air is supplied to the reactor and the oxygen content of the air supplied to the reactor.

4. A process as recited in claim 1 wherein the flue gas has a calorific value of about 150 BTU/scf.

5. A process as recited in claim 1 further comprising removing a portion of the oxides of nitrogen in the flue gas.

6. A process as recited in claim 1 wherein the oxygen added to the air supplied to the reactor is produced by a vacuum swing adsorption process.

7. A process as recited in claim 1 wherein the oxygen added to the air supplied to the reactor is produced by a pressure swing adsorption process.

8. A process for producing carbon black comprising:

(a) operating a furnace-type reactor using a hydrocarbon fuel to produce carbon black and a combustible flue gas;

(b) calculating the combustion gas temperature; percentage of oxygen at a selected point in the reactor, and the total heat input rate above a selected datum;

(c) replacing the hydrocarbon fuel with a portion of the combustible flue gas produced by the process;

(d) adjusting the flue gas input rate to provide about the same combustion gas temperature as that calculated in step (b);

(e) adjusting each of the air input rate, supplemental oxygen input rate, and fuel input rate by about the same percentage to achieve about the same total heat input rate above the selected datum as that calculated in step (b);

(f) calculating the resulting percentage of oxygen at the selected point in the reactor;

(g) adjusting the feed rate of supplemental oxygen and repeating steps (d) through (f), above until the calculated percentage of oxygen at the selected point in the reactor is about the same as that calculated in step (b); and,

(h) repeating steps (d) through (g) until the calculated combustion gas temperature; percentage of oxygen at the selected point in the reactor, and the total heat input rate above the selected datum are each about the same as that calculated in step (b).

9. A process as recited in claim 8 wherein the selected point in the reactor for calculating the percentage of oxygen is immediately upstream of the feedstock oil injection point.

10. A process as recited in claim 8 wherein the selected datum is 77°F.

11. A process for producing carbon black comprising:

(a) operating a furnace-type reactor using a hydrocarbon fuel to produce carbon black and a combustible flue gas;

(b) calculating the combustion gas temperature; percentage of oxygen at a selected point in the reactor, and the total heat input rate above a selected datum;

(c) replacing the hydrocarbon fuel with a portion of the combustible flue gas produced by the process;

(d) adjusting the flue gas input rate to provide about the same combustion gas temperature as that calculated in step (b);

(e) adjusting each of the air input rate, supplemental oxygen input rate, and fuel input rate by about the same percentage to achieve about the same total heat input rate above the selected datum as that calculated in step (b);

(f) calculating the resulting percentage of oxygen at the selected point in the reactor;

(g) selecting a desired percentage of oxygen at the selected point in the reactor;

(h) adjusting the feed rate of supplemental oxygen and repeating steps (d) through (f), above until the calculated percentage of oxygen at the selected point in the reactor is about the same as that selected in step (g); and,

(i) repeating steps (d), (e), (f) and (h) until the calculated combustion gas temperature and the total heat input rate above the selected datum are each about the same as that calculated in step (b) and the percentage of oxygen at the selected point in the reactor is about the same as that selected in step (g).

12. A process as recited in claim 11 wherein the selected point in the reactor for calculating the percentage of oxygen is immediately upstream of the feedstock oil injection point.

13. A process as recited in claim 11 wherein the selected datum is 77°F.

14. A method of controlling a furnace-type carbon black reactor comprising:

calculating the combustion gas temperature and the oxygen concentration in the combustion gas within a selected region of the reactor; and,

adjusting one or more parameters selected from the group consisting of fuel rate and oxygen content of the oxidizer stream to maintain approximately constant heat input rate at a constant combustion temperature, the combustion gas temperature and the oxygen concentration in the combustion gas within the selected region of the reactor.

15. A method as recited in claim 14 wherein the selected region of the reactor is the region in which feedstock oil is injected into the reactor.

16. A method as recited in claim 14 wherein the fuel supplied to the reactor is natural gas.

17. A method as recited in claim 14 wherein the fuel supplied to the reactor is a hydrocarbon.

18. A method as recited in claim 17 wherein the hydrocarbon is a liquid at room temperature and pressure.